RESPONSE OF CROPS TO SULPHUR IN NORTHEASTERN SASKATCHEWAN

By W. F. Nuttall
Research Station
Melfort, Saskatchewan

Approximately fifty years ago, crops grown on Gray Wooded soils were observed to respond to sulphur fertilizer. Since that time until very recently, a general recommendation was made to apply S fertilizer on these soils. Farmers were advised to leave a check strip to determine by observation if sulphur should be applied the following year. Some of the nitrogen and phosphate fertilizers also contained sulphur which was an added bonus because the cost of the fertilizer was based on the N and P concentration.

With higher rates of N and P; more concentrated, higher analyses fertilizers; and removal of S by grain from the soil over a period of years; a larger area of soils will be depleted of this element.

Accordingly, fertilizer trials with sulphur were carried out at three sites in northeastern Saskatchewan over a period of six years. The objectives of these experiments were to determine: 1) If the $CaCl_2$ soluble S soil test would give an adequate indication of sulphur deficiency, 2) What rates of S should be applied, 3) What accumulation or depletion of $CaCl_2$ soluble sulphur would occur over a period of years, 4) What uptake and concentration of S would occur in plant material, and 5) If differences in response occur between different sources of S fertilizers.

Results showed that Rambler alfalfa responded to N and S fertilizer (Table 1); that elemental S is equivalent or better than sulphate-S fertilizers, Table 2 (one years data). Response of alfalfa to S has only occurred the second year after establishment. There is some indication that response of alfalfa to S may occur on Deep Black, chernozemic soils (Table 3).

Residual response of oats to gypsum occurred in an older trial in 1956 with 21 kg S/ha applied (100 pounds gypsum/acres, Table 4).

Bonanza barley significantly responded to N and P fertilizer. Yields with S applied were numerically higher, but not significantly higher than control treatments (Table 5). Similarly with Torch rape, response to N was significant, but P and S effects were not shown to be significant (Table 6).

Calcium chloride soluble soil S in plots was higher and tended to increase with time if 45 kg S/ha were applied each year in a Barley, Rape and Fallow rotation and in a continuous stand of alfalfa (Figs. 1 and 2).

Table 1. Yield response of Rambler alfalfa herbage to NPS fertilizer at Archerwill on Waitville loam - 1973-77

Code	Fertilizer N	P	S	Dry Matter Yield 1977	1973-77
	KG/HA			KG/HA	
1	10	20	0	3978	4154
2	10	20	22	3587	4927
3	10	20	45	3624	4820
4	45	20	0	4192	4724
5	45	20	22	4955	5327
6	45	20	45	6196	5813
7	67	20	0	5684	4575
8	67	20	22	4945	5460
9	67	20	45	4853	5161
10	10	0	0	3235	4065
11	0	0	0	3271	3842
12	22	0	26	5539	5361
13	10	10	0	4198	4237

Table 2. Yield response of Rambler alfalfa herbage to elemental S(Agri-sul) and sodium sulphate.

Code	Treatment N	P	S	Sulphur Source	Dry Matter Yield 1977	1978*	Mean
	KG/HA					KG/HA	
1	10	20	0		2260	1957	2109
2	10	20	22	AGRI-S	2149	2902	2526
3	10	20	45	AGRI-S	1980	2767	2374
4	10	20	45	NA_2SO_4	2222	1879	2051

AGRI-S - Prilled elemental sulphur.

NA_2SO_4 - Sodium sulphate.

* F test was significant at 5% probability level, cut 2.

Table 3. Yield of Rambler alfalfa herbage on Melfort silty clay, 1978 - established 1974

Code	Fertilizer N	P	S	Dry Matter Yield
	KG/HA			KG/HA
1	10	20	0	7319
2	10	20	22	6882
3	10	20	45	8065
4	45	20	0	7724
5	45	20	22	6334
6	45	20	45	9065
7	67	20	0	7355
8	67	20	22	7510
9	67	20	56	7699
10	10	0	0	7280
11	0	0	0	7385
12	22	0	26	7181
13	10	10	0	7707

Table 4. Effect of Gypsum applied in 1955 on yield of Oats in 1956 (residual)

Fertilizer (1955) N	P	K	Gypsum ($CaSO_4 \cdot 2H_2O$) kg S/ha 0	21*
KG/HA			KG/HA	
6.7	7.3	0.0	2951	3088
13.4	7.3	0.0	2803	2715
6.7	14.7	0.0	2864	3427
13.4	14.7	0.0	2471	3233
6.7	7.3	14.0	2917	2955
6.7	14.7	14.0	2906	2822
13.4	7.3	14.0	2650	2966
13.4	14.7	14.0	2799	2582
0.0	0.0	0.0	2753	2848
	Mean		2791	2959

* F test significant at 5% probability level

Table 5. Response of Bonanza barley grown on stubble to N, P, and S at Archerwill on Waitville Loam, 1975 to 1977

Code	Fertilizer N	P	S	Grain Yield
	KG/HA			KG/HA
1	10	20	0	3110
2	10	20	22	3235
3	10	20	45	3185
4	45	20	0	3167
5	45	20	22	3565
6	45	20	45	3467
7	67	20	0	3442
8	67	20	22	3428
9	67	20	45	3513
10	10	0	0	2618
11	0	0	0	2709
12	22	0	26	2665
13	10	10	0	3009

Table 6. Response of Torch rape grown on stubble to N, P and S at Archerwill on Waitville Loam, 1975 to 1977.

Code	Fertilizer N	P	S	Grain Yield
	KG/HA			KG/HA
1	10	20	0	951
2	10	20	22	980
3	10	20	45	960
4	45	20	0	1180
5	45	20	22	1210
6	45	20	45	1071
7	67	20	0	1194
8	67	20	22	1321
9	67	20	45	1388
10	10	0	0	942
11	0	0	0	798
12	22	0	26	1062
13	10	10	0	866

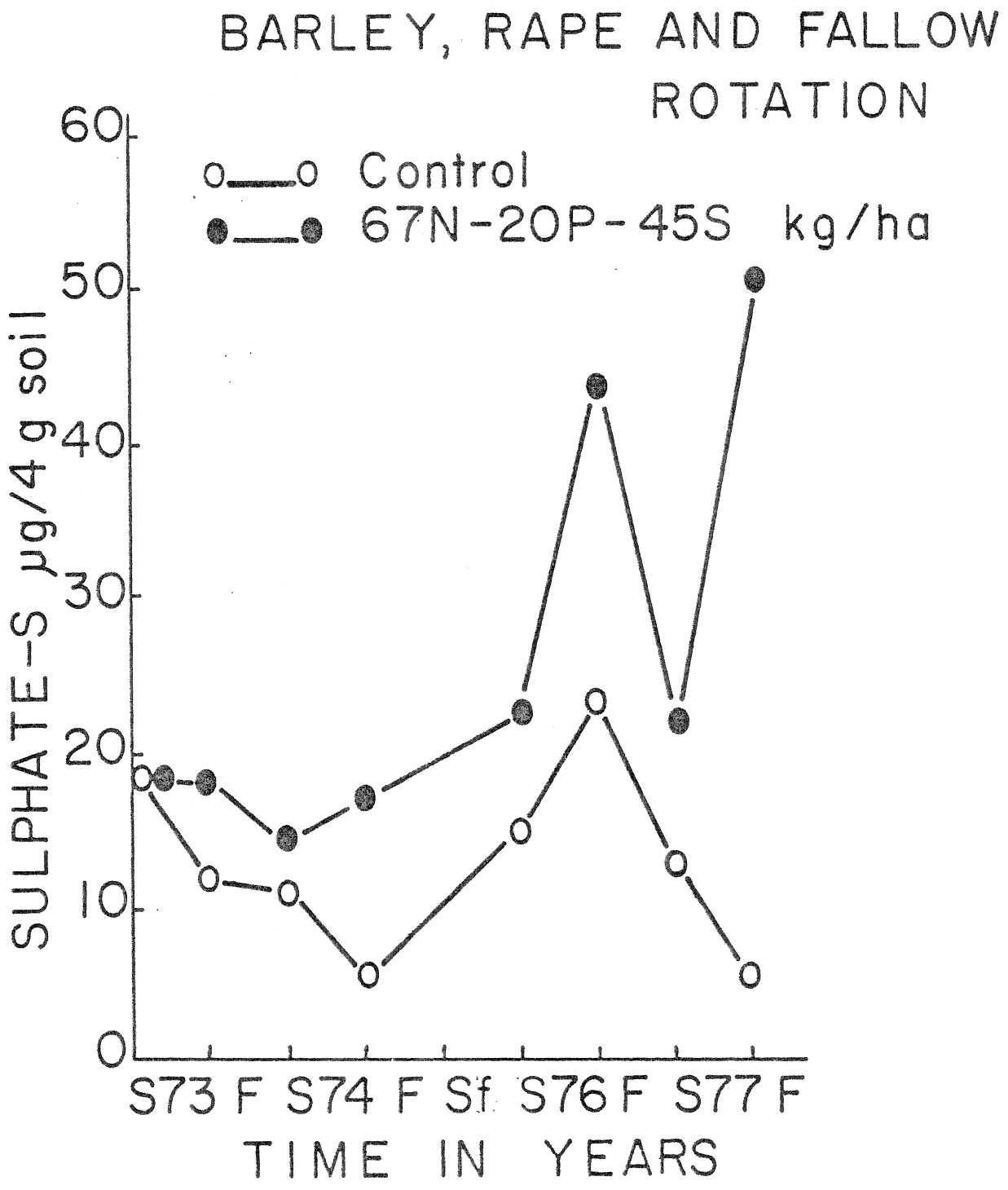

Fig. 1 Calcium chloride soluble sulphate-S in Waitville loam soil measured in the spring (S) and fall (F). Sf refers to summerfallow in 1975.

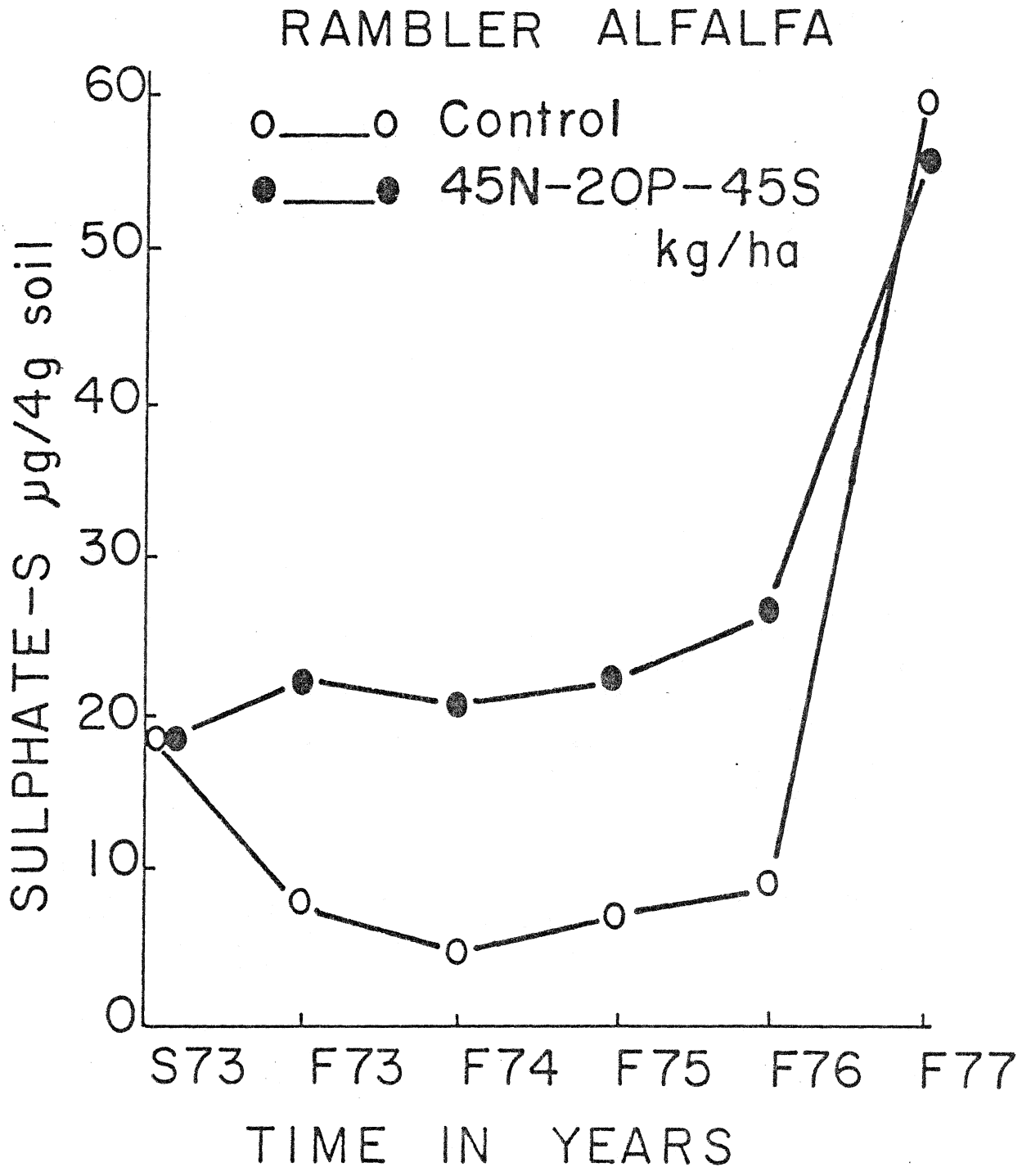

Fig. 2 Calcium chloride soluble sulphate-S in Waitville loam soil measured in the spring (S) and fall (F).